

Status Report

2001

**Black-tailed Prairie Dog Monitoring at
Scotts Bluff National Monument**

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1.0 INTRODUCTION

1.1 Background

Black-tailed prairie dog (*Cynomys ludovicianus*, BTPD) historically occupied over 100 million acres of shortgrass and mixed-grass prairie in 11 western states (National Wildlife Federation 2000a). Currently less than one percent of this habitat remains occupied, 700,000 to 800,000 acres. The dramatic decline in BTPD habitat and abundance is the result of changing land use patterns, habitat fragmentation, disease, shooting, and poisoning (U.S. Fish and Wildlife Service 2000). Sylvatic plague (*Yersinia pestis*), introduced from Europe and first identified in prairie dog populations in the mid-1930's (Hubbard 1947) is capable of causing massive die-offs in prairie dog populations (Barnes 1993, Cully 1993). Wide spread control of prairie dogs through shooting and poisoning is still being practiced in most states. Most states require the eradication of the species on private and publicly held lands at the expense of the landowner (Desmond et al. 2000). Species dependent on the BTPD for food or the habitat they produce include the Burrowing owl (*Athene cunicularia*), Mountain plover (*Charadrius montana*), Kit fox (*Vulpes velox*), and Ferruginous hawk (*Buteo regalis*) (National Wildlife Federation 2000c). These species are candidates or potential candidates for listing as threatened species under the Endangered Species Act of 1973. America's most endangered mammal; the Black-footed ferret (*Mustela nigripes*) is wholly dependent on the prairie dog for its survival (National Wildlife Federation 2000c).

Concerns for recovering the BTPD to stable numbers on National Park Service (NPS) lands has prompted the Park Service to identify parks and monuments within the historic range of the BTPD that still host populations of prairie dogs. Seven of the 29 parks or monuments within the historic range of the BTPD still maintain populations (Badland's National Park, SD; Bent's Old Fort National Historic Site, CO; Devil's Tower National Monument, WY; Fort Larned National Historic Site, KS; Scotts Bluff National Monument, NE; Theodore Roosevelt National Park, ND; and Wind Cave National Park, SD).

The colony of BTPD at Scotts Bluff National Monument, Nebraska (SCBL) was reestablished in 1981 from vagrant individuals moving onto the monument. Black-tailed prairie dogs had been exterminated from the monument in 1944. Colony size, population densities, and estimates of overall abundance of BTPD at SCBL from 1981 through 1994 are given in Table 1. The rapid and sustained decline in BTPD numbers between 1988 and 1995 could be the result of several factors including illegal shooting or poisoning, poor winter survival, predation, or Sylvatic plague (Knowles 1998).

For the period 1995 - 1999, BTPD were monitored through a joint effort of the Prairie Cluster Long-Term Ecological Monitoring Program (PC-LTEM) and the Biological Resources Division (BRD) of the U.S. Geological Survey. A peer-reviewed monitoring protocol is the result of this endeavor (Plumb et al. 2001). Park personnel and PC-LTEM staff continue annual BTPD monitoring. This report describes monitoring results for 2001.

1.2 Objectives

The objectives of BTPD monitoring at SCBL is to: 1) estimate BTPD population abundance; 2) map annual size and location of the BTPD colony; and 3) determine through observation if Sylvatic plague (*Yersinia pestis*) is present in the BTPD colony.

2.0 METHODS

2.1 Black-tailed Prairie Dog Density and Abundance

Plumb et al. (2001) detail the current monitoring methods used to estimate BTPD densities, abundance and colony size. The BTPD colony at SCBL was observed from two viewing stands in 2001. Eight replicate counts, with 15-minute intervals between the start of each replicate, were made from each stand on each of three days, July 24 - 26. Observations were made on sections of the colony predetermined for each stand in an attempt to minimize counting individuals twice during a replicate, yet allow for the counting of individuals across the whole colony. Therefore, daily replicate counts from each stand were combined in order to calculate estimates of population density and size. Prairie dogs on the east and part of the southern sections of the colony were counted from a stand located on the eastern edge of the colony (Figure 3). Prairie dogs from the north, west and extreme southern section of the colony were counted from a stand located in the middle of the colony. Surveys were conducted between 6:45 – 8:45 am on mornings with no precipitation, temperatures > 10 °C (50 °F) and wind speeds < 32 kph (20 mph). Timing of replicate counts from each stand was synchronized so counts could be combined.

Using the combined visual count data, two calculations were made to estimate annual BTPD density and abundance within the colony at SCBL.

Density (P) = $([Y / Sp] - 3.04) / 0.40$, where Y is the maximum count of individuals in a replicate over the three day survey period and Sp the total area sampled.

Abundance (T) = $(Sc)(P)$, where Sc is the total colony size in hectares and P the estimated density per hectare.

A 95 % confidence interval was calculated for density and abundance using the following formulas:

$$\text{Density lower limit, } P = P - 1.96 [SE(P)]$$

$$\text{Density upper limit, } P = P + 1.96 [SE(P)]$$

$$\text{Abundance lower limit, } T = T - 1.96 [SE(T)]$$

$$\text{Abundance upper limit, } T = T + 1.96 [SE(T)]$$

where SE is the standard error for Density (P) and Abundance (T), respectively. Standard error (SE) is derived by first calculating Variance (P) = $66 + 0.025 (P - 18.4)^2$ for Density (P) or Variance (T) = $66 + 0.025 (T - 18.4)^2$ for Abundance (T) and then calculating $SE (P \text{ or } T) = \sqrt{\text{Variance } (P \text{ or } T)}$. Means with widely overlapping confidence intervals are not significantly different.

2.2 Black-tailed Prairie Dog Colony Mapping

Boundaries of active burrows and active clip line on the BTPD colony at SCBL were delineated using a Global Positioning System in conjunction with a PC-based

Geographic Exploration Systems, ArcViewTM. Burrows were classified as active if burrow openings were > 7-cm in diameter, the burrow was within 5-m of an active clip line, and fresh scat was observed within 0.5-m of the opening. Burrows were not classified as active if there were spider webs across an opening or unclipped vegetation growing in or around the opening (Biggins et al. 1993, Desmond et al. 2000). Colored pin flags were used to mark the active burrows on the perimeter of the colony and delineate the perimeter of the active clip line prior to GPS mapping. In most cases the active clip line was easily distinguishable. However, when an active clip line was not apparent, the extent of the active burrow closest to clipped vegetation was mapped. One area of ungrazed vegetation within the colony was excised from the active clip line and active burrow mapping to minimize the amount of unoccupied grassland included in colony size estimates. Boundaries were walked in their entirety regardless of which mapping technique was employed in order to close the colony polygons.

Colony size was determined by combining the greatest extent of both active burrows and active clip line. The two parameters were combined in order to map the largest extent of active colony perimeter. As a rule, the mapping of both parameters produces varying yet statistically similar estimates of colony size (Plumb et al. 2001). Therefore, combining both active burrows and active clip line within years gives a more robust measure of colony size.

2.3 Sylvatic Plague Surveillance

Park personnel monitor Sylvatic plague presence within the BTPD colony at SCBL throughout the year. Observation of a substantial die-off in the population during the year alerts park personnel to the potential of a Sylvatic plague outbreak. If a Sylvatic plague outbreak is suspected, appropriate authorities that can verify the presence or absence of Sylvatic plague will be notified. Sylvatic plague was not observed in the BTPD population during the 2001-monitoring-year.

2.4 Vegetation Monitoring

During 2001 an attempt was made to quantify the percent of the BTPD colony visually obstructed by vegetation from observers view. A randomly located 25 x 25-m systematic grid was overlain on the colony and used for vegetation density monitoring. Twenty-five points, 14% of the total possible points within the colony were randomly selected for vegetation monitoring. Horizontal vegetation density was read from 15-m north (azimuth set at zero) of each point at 0 – 0.5-m and 0.5-1.0-m in height, vegetation did not exceed 1.0-m in height. Horizontal vegetation density was recorded by cover classes with 0 = nothing present; 1 = trace vegetation cover; 2 = 1-5%; 3 = 6-25%; 4 = 26-50%; 5 = 51-75%; 6 = 76-95%; 7 = 96-100%. Cover was the estimated amount of a 15-cm wide vertical board that was obscured from view at the 15-m distance.

Future vegetation monitoring on the BTPD colony at SCBL may be expanded to include estimates of foliar ground cover and aboveground annual primary production. Appendix A outlines the rational and objectives for increasing vegetation monitoring efforts on the BTPD colony at SCBL and the methodologies to be implemented.

3.0 RESULTS

3.1 Black-tailed Prairie Dog Abundance and Density

The results of BTPD monitoring in 2001 are given in Table 2 and Figures 1 and 2, along with the previous six years. Population size in 2001 was estimated at 255 individuals, demonstrating an increase of 106 individuals (71%) over 2000 levels (Figure 1). The BTPD population estimate was 144 individuals higher than the seven year average (1995-2001) of 110.7 individuals / year. This was the largest population recorded to date under the current monitoring protocol (in use since 1995). The density of BTPD was 23.4 individuals / ha in 2001, representing an increase of 14.2 individuals / ha (154%) over 2000 density (Figure 2). Density averaged 4.3 individuals / ha greater than the seven year average (1995-2001) of 19.1 individuals / ha.

3.2 Black-tailed Prairie Dog Colony Mapping

Maps showing changes in the location and extent of the BTPD colony at SCBL between 1995 and 2001 are shown in Figures 3. The colony area was 10.9 ha in 2001, representing a decrease in size of 5.3 ha (33%) from 2000 (Table 2). The relative shape and location of the colony was unchanged. Colony size was 4.3 ha larger than the seven year average of 6.6 ha.

3.3 Sylvatic Plague Surveillance

Sylvatic plague was not observed in the BTPD colony at SCBL during 2001.

3.4 Vegetation Monitoring

Horizontal vegetation density averaged between 51 and 75% coverage for the first 0.5-m of height and a trace amount for the 0.5 to 1.0-m of height. Vegetation greater than 1.0-m in height was not observed on the BTPD colony at SCBL during 2001. Vegetation was sufficiently short and sparse enough not to influence observers viewing BTPD during counts.

4.0 DISCUSSION

During 2001, BTPD counts were taken from two observation towers strategically positioned on the colony (Figure 3). Positioning the observation towers in two locations aided observers in viewing the entire colony during surveys. Previously, BTPD surveys were conducted from one observation tower. But, colony mapping in 2000 showed that the colony was of a size and complexity sufficient to require it being divided into two sections for the 2001 BTPD counts. Plumb et al. (2001) recommended conducting visual counts on a single 200 x 200-m section of a colony. However, the unique crescent shape of the BTPD colony at SCBL and variations in population densities across the colony dictated dividing the colony into two sections for visual counts and subsequently sampling the entire colony. In the future, two stands will be used for observing the colony unless its size, topography, and vegetative cover become such that one observation tower is sufficient.

It appears that the rapid outward expansion of the BTPD colony observed in 1999 and 2000 has ceased, and areas of the colony previously abandoned were re-colonized (Figure 3). Perhaps areas idled from grazing by BTPB in 1999-2000 had soil conditions

favorable for vegetative growth and prairie dogs utilized these areas over areas of colony expansion. More favorable climatic conditions (increased precipitation) in 2001 over 2000 (Figure 4) may have also resulted in more nutritious vegetation within the colony. Regardless of the cause, the presence of greener more nutritious vegetation on the colony appears to have deterred colony expansion and encouraged re-colonization of abandoned areas. Both, BTPD numbers and density were greater in 2001 than 2000 even with the amount of occupied colony being less.

Declines in the density of BTPD at SCBL since 1997 seem to have reversed themselves. The population density was the second highest recorded under the new monitoring protocol (implemented in 1995) and averaged only 5.5 individuals / ha below the 1997 high of 28.9 individuals / ha (Figure 2). Population size was the highest recorded under the current monitoring effort (Figure 1). Therefore, the increased population and the decline in occupied colony size resulted in the substantial increase in the estimated density of BTPD. The greener more nutritious vegetation allowed for higher numbers of prairie dogs to occupy a colony of a smaller size. However, the BTPD density estimate was not significantly different between this year and any other year since 1995 based on overlapping confidence intervals (Figure 2).

Horizontal vegetation density was measured for the first time on the colony since the new protocol was implemented. Vegetation was rarely over 0.5-m in height therefore it did not pose a serious problem for accurately viewing and counting BTPD. Strategically positioning our elevated observation stands in combination with shorter vegetation allowed us the opportunity to get accurate counts on the prairie dogs. Vegetation height and density did not influence this years count as much as they may have in previous years. Field notes from the two previous years of BTPD surveying suggest that sweet clover (*Melilotus spp.*) was of a sufficient height to hinder observers from seeing individuals from all sections of the colony. This was especially true when only one observation tower was used. Sweet clover was a minor component of the colony vegetation in 2001.

Presently, the colony occupies a small portion of the monument, <2% of the monument's 698-ha of grassland. Physical barriers curtailing BTPD colony expansions limit future increases in colony size. Ridges created when wind blown sediment was deposited along fence lines bound the south side and a portion of the east side of the colony. The fenced boundary and adjacent private cropland limit expansion to the west. To the north, a large irrigation canal and road bound the colony, precluding colony expansion in that direction. In recent years, the colony has expanded to the east, a trend that may continue until the colony reaches a north-south oriented ditch. Because, intra-colony expansion is limited, dispersal from the colony and the establishment of new colonies could occur. Monument staff should look for new occurrences of BTPD in other areas of the monument. Dispersal usually begins in late winter and is complete by the end of June (Garrett and Franklin 1988, Hoogland 1995).

For reasons already outlined, BTPD monitoring at SCBL will continue with the use of two observation towers during visual counts. Annual mapping of the colony will allow resource managers the opportunity to assess the impacts of colony expansions on the cultural and natural resources of the monument. Sylvatic plague surveillance as well as the surveillance for other mortality factors will continue to be a routine part of the assessment of the BTPD colony at SCBL. Surveillance of mortality factors must be

undertaken if a rapid decline in the BTPD population is observed to minimize the risk to human health without causing undue concerns. Vegetation monitoring will continue and may be expanded to help answer questions concerning colony use and expansion. If the potential for colony expansion into other parts of the Monument become a concern this information will also help to assess the impacts of these expansions. Present vegetation monitoring allows us the opportunity to assess if vegetation was of sufficient height to obstruct the view of prairie dogs in any sections of the colony. However, it does not allow us the opportunity to assess the quality of habitat within the colony. If the BTPD becomes listed as a threatened species, recovering their numbers may require colonies being established in other locations within the park. Coincidental counts of Burrowing owls found one individual on the colony, down from five in 2000. Sightings of Burrowing owls will continue to be recorded whenever made and included in annual reports. Findings from this monitoring effort on BTPD at SCBL should be incorporated with those from other National Park Service lands in order to help recover this element of the prairie ecosystem to sustainable numbers.

5.0 PLANS FOR 2002

Plumb et al. (2001) details the monitoring methodology that will be used to estimate BTPD densities, abundance and colony size at SCBL. The BTPD colony will again be observed from two viewing stands in 2002. Eight replicate counts, with 15-minute intervals between the start of each replicate, will be made from each stand on each of three days in mid-July. Observations will be made on sections of the colony predetermined for each stand to minimize counting individuals twice during a replicate, yet allow for the counting of individuals across the entire colony. Therefore, daily replicate counts from each stand will need to be combined in order to calculate estimates of population density and size. Surveys will be conducted between 6:45 – 8:45 am on mornings with no precipitation, temperatures $> 10^{\circ}\text{C}$ (50°F) and wind speeds < 32 kph (20 mph). Timing of replicate counts from each stand will be synchronized so counts can be combined.

Boundaries of active burrows and active clip line on the BTPD colony at SCBL will be delineated using a Global Positioning System in conjunction with a PC-based Geographic Exploration Systems, ArcViewTM. Burrows will be classified as active following the protocol outlined by Plumb et al. (2001). Colored pin flags will be used to mark the active burrows on the perimeter of the colony and delineate the perimeter of the active clip line prior to GPS mapping. Colony size will be determined by combining the greatest extent of both active burrows and active clip line.

Park personnel will monitor Sylvatic plague presence within the BTPD colony at SCBL throughout the year. Observation of a substantial die-off in the population during the year will alert park personnel to the potential of a Sylvatic plague outbreak. If a Sylvatic plague outbreak is suspected, appropriate authorities that can verify the presence or absence of Sylvatic plague will be notified.

During 2001 an attempt was made to quantify the percent of the BTPD colony at SCBL visually obstructed by vegetation from observers view. This vegetation monitoring effort will continue in 2002. Additionally, vegetation monitoring on the BTPD colony may be expanded to include estimates of foliar ground cover and annual

aboveground primary production. Appendix A outlines the rational and objectives for increasing our vegetation monitoring effort and the methodologies to be implemented.

6.0 REFERENCES

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Table 1. Colony size, population density and number of individual Black-tailed Prairie Dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska between population reestablishment and 1994. Sources of annual data are indicated.

Year	Area (ha)	Density (individuals/ha)	Population Size	Source
1981	Colony Reestablishment in Scott's Bluff National Monument			
1982	--	--	--	None
1983	0.98	76.5	75	Franklin 1984
1984	1.31	30.5	40	Franklin 1984
1985	--	--	107	Cox and Franklin 1989
1986	5.77	34.7	200	Cox and Franklin 1989
1987	5.14	58.9	303	Cox and Franklin 1989
1988	3.39	64.6	219	Cox and Franklin 1989
1989	--	--	62	Monument Personnel unpub.
1990	--	--	62	Monument Personnel unpub.
1991	--	--	27	Monument Personnel unpub.
1992	--	--	--	None
1993	--	--	45	Monument Personnel unpub.
1994	--	--	--	None

Table 2. Colony size (95% CI), population density (95% CI) and number of individual Black-tailed Prairie Dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska between 1995 and 2001.

Year	Area (ha)	Density (individuals/ha)	Population Size
1995	1.4	12 (-4.1-28.1)	17 (1.1-32.9)
1996	1.4	21 (5.1-36.9)	29 (12.7-45.2)
1997	2.6	28.9 (12.7-45.2)	75 (51.3-98.7)
1998	3.3	22.7 (6.7-38.7)	75 (51.3-98.7)
1999	10.5	16.7 (0.8-32.6)	175 (123.9-226.1)
2000	16.2	9.2 (0.9-17.5)	149 (105.5-192.5)
2001	10.9	23.4 (7.4-39.4)	255 (179.7-329.6)

Figure 1. Estimated Black-tailed prairie dog population estimates (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska for years 1995 to 2001. Bars at each annual population estimate represent a calculated confidence interval for that year. It is assumed that years with widely overlapping confidence intervals about their population estimate are not significantly different.

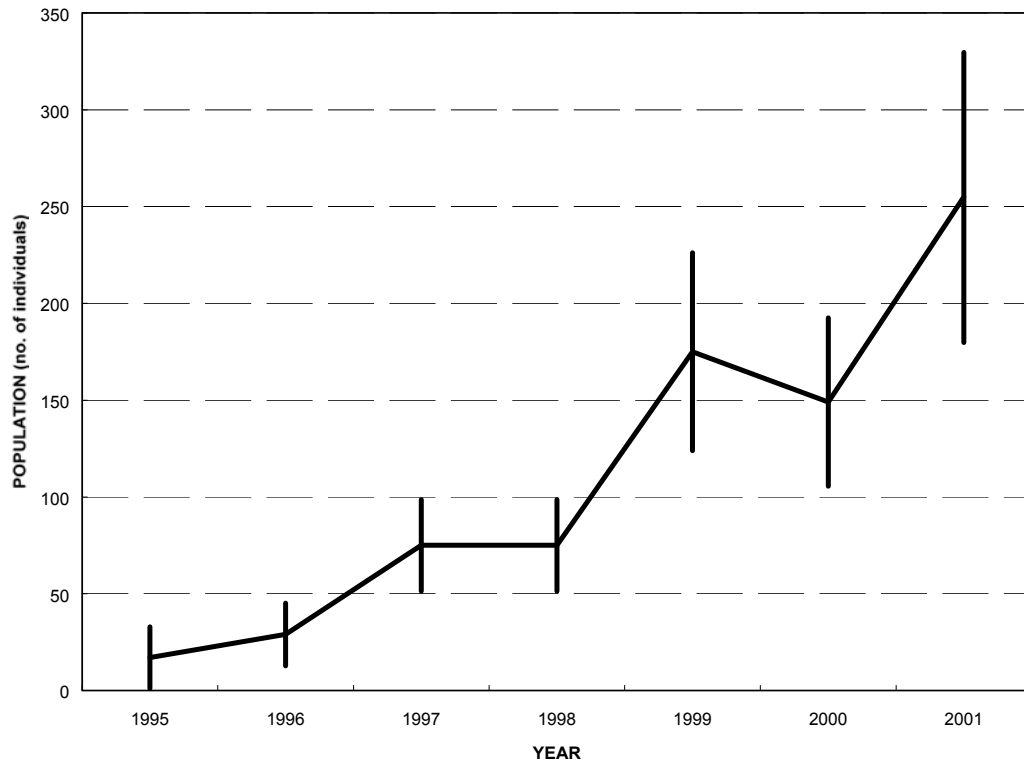


Figure 2. Estimated Black-tailed prairie dog densities (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska for years 1995 to 2001. Bars at each annual density estimate represent a calculated confidence interval for that year. It is assumed that years with widely overlapping confidence intervals about their density estimate are not significantly different.

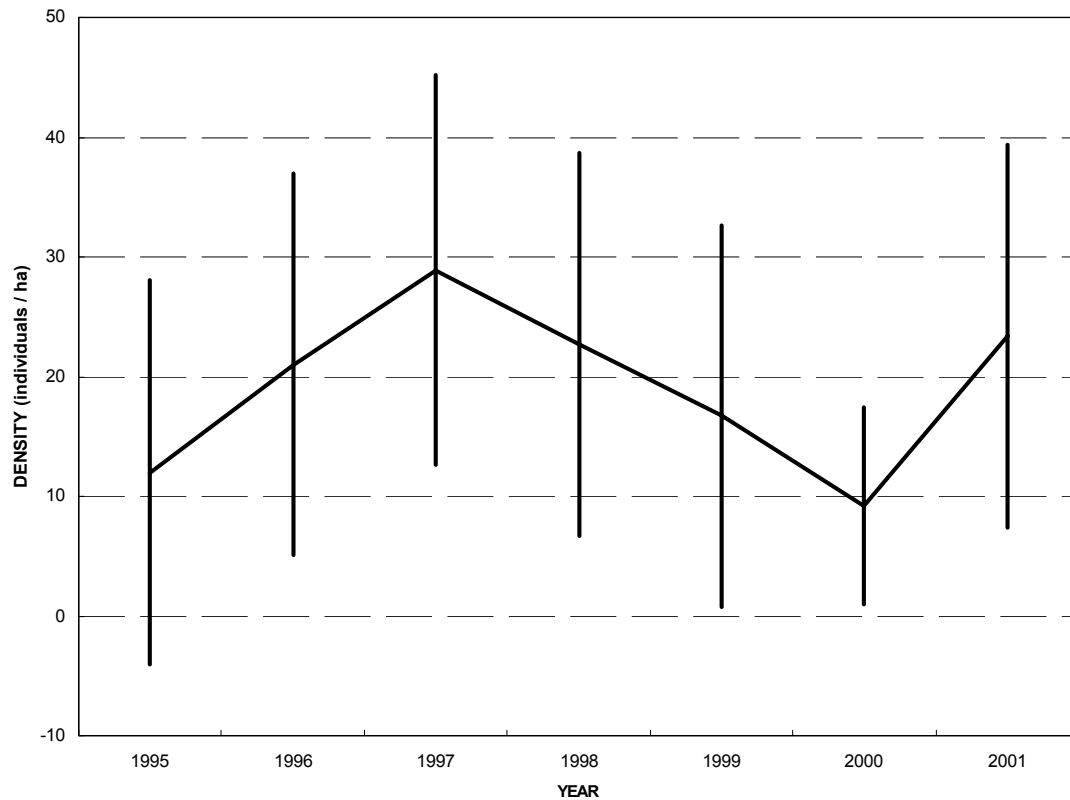


Figure 3. Black-tailed prairie dog (*Cynomys ludovicianus*) colony sizes and shapes at Scotts Bluff National Monument, Nebraska for years 1995 to 2001, exception 1996. The colony size and shape was roughly the same for 1995 and 1996. The colony boundary for 1995 is shown on all years as a reference.

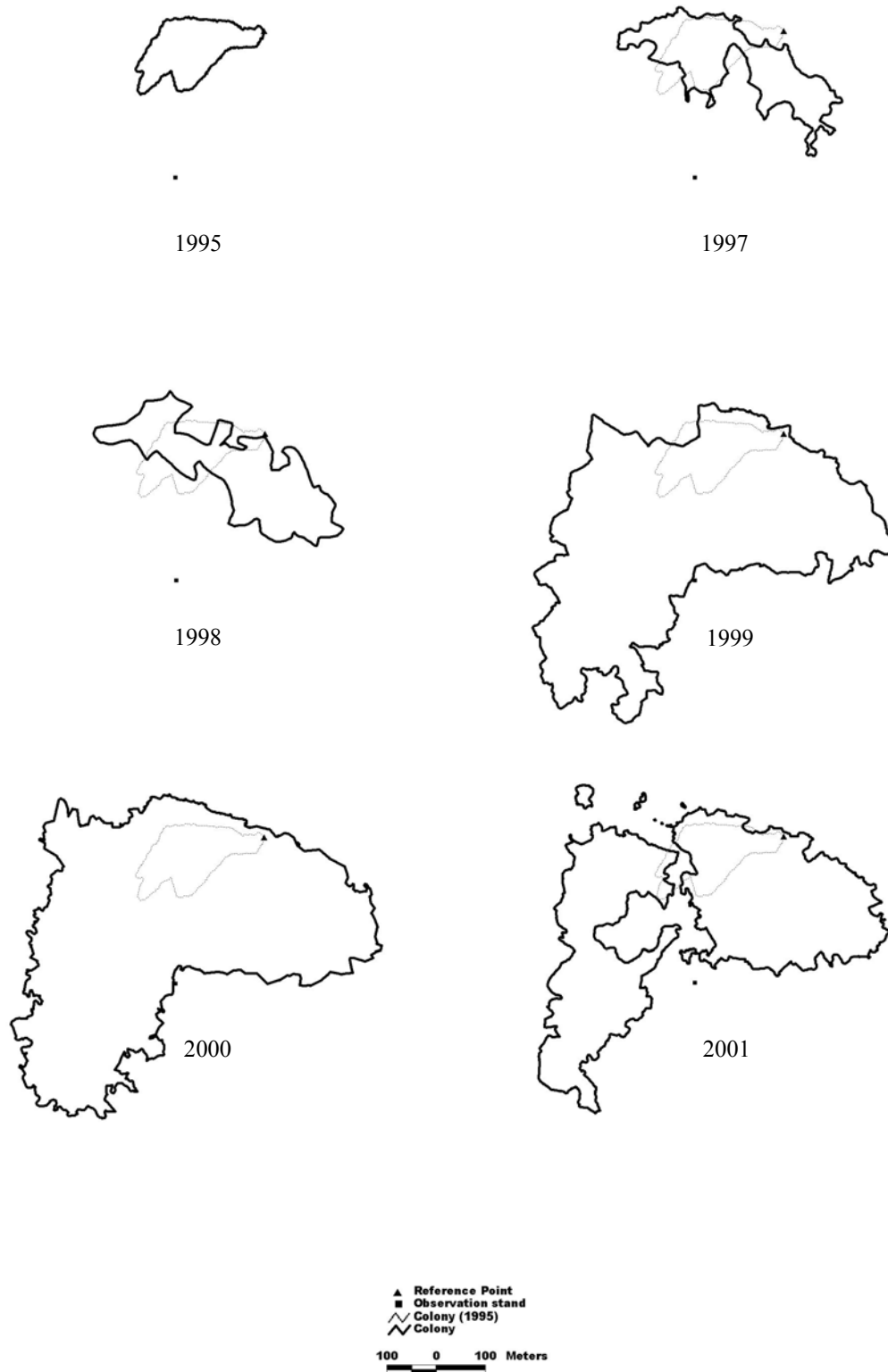
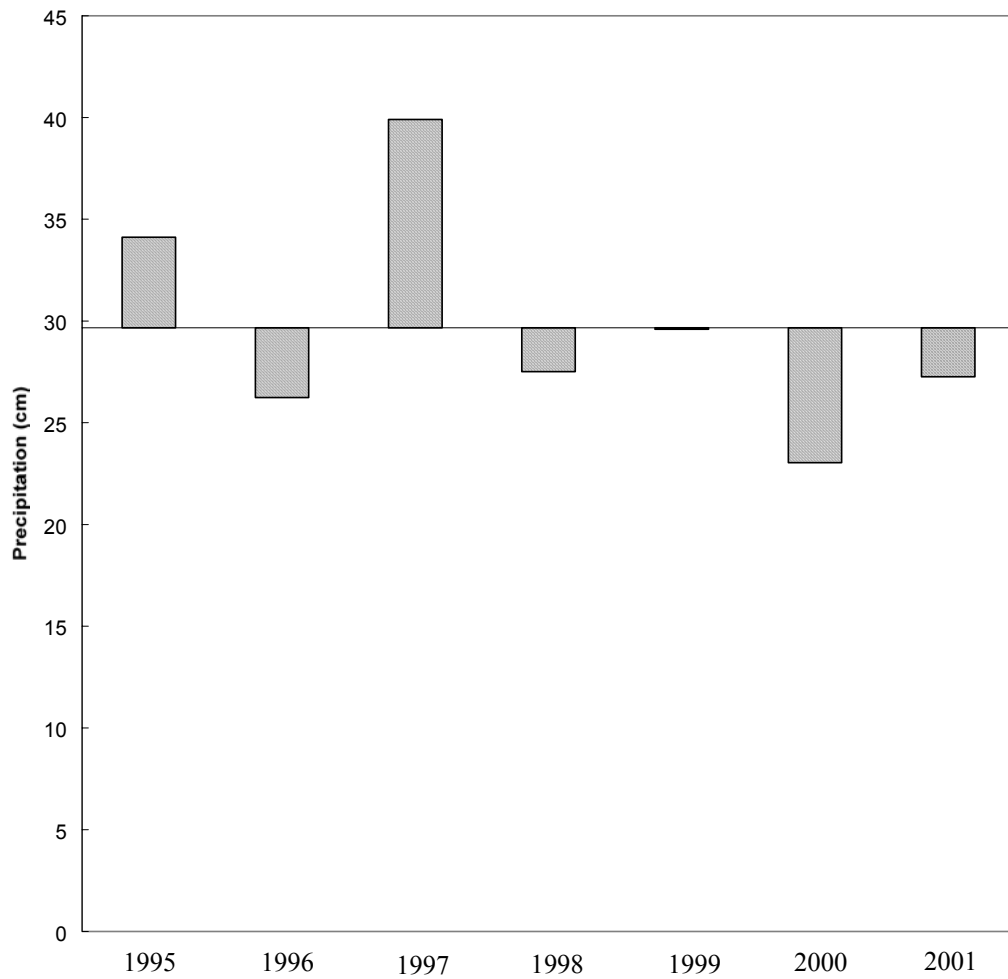


Figure 4. Cumulative precipitation for the first seven months of each year shown annually as deviations from the seven year average (1995-2001) at Scotts Bluff National Monument, Nebraska. Precipitation averaged 29.66 cm for the first seven months of a year.



7.0 APPENDIX A

Proposed:

Vegetation Monitoring on The Black-tailed Prairie Dog

Colony at Scotts Bluff National Monument

7.1 OBJECTIVES

The objectives of vegetation monitoring on the BTPD colony at SCBL is to: 1) estimate the percent of the colony obstructed from view by vegetation; 2) estimate foliar cover of vegetation by guilds; and 3) make inferences about annual aboveground primary production available for grazing by BTPD.

7.2 METHODS

7.2.1 Grid Establishment

In 2001, a randomly located sampling grid was established for the area containing the BTPD colony at SCBL. Twenty-five points within the colony were randomly located at line intersects on the grid and used for vegetation density monitoring. This sampling grid will be utilized in future monitoring efforts. However, vegetation monitoring will use points re-randomized on the grid each year with the goal of sampling 10 – 20 % of the points located on the active colony. All points are located in the field using GPS.

7.2.2 Measuring Vegetation Obstructing Observers View

Horizontal vegetation density is read from 15-m north (azimuth set at zero) of each point at 0 – 0.5-m, 0.5-1.0-m, 1.0-1.5-m, and 1.5-2.0-m in height. Horizontal vegetation density is recorded by cover classes for live vegetation only, with 0 = nothing present; 1 = trace vegetation cover; 2 = 1-5%; 3 = 6-25%; 4 = 26-50%; 5 = 51-75%; 6 = 76-95%; 7 = 96-100%. Cover is the estimated amount of a 15-cm wide vertical board that is obscured from view at the 15-m distance.

7.2.3 Estimating Ground Cover

In 10 m² circular plot centered on each point, foliar cover of each herbaceous plant guild is ocularly estimated using a cover class index modified from Daubenmire (1959) (0 = nothing present; 1 = trace cover; 2 = 1-5%; 3 = 6-25%; 4 = 26-50%; 5 = 51-75%; 6 = 76-95%; 7 = 96-100%). Species rooted in the plot are recorded in estimates of foliar cover. Only live vegetation is included in foliar cover estimates. Bare ground, rock and litter cover in each plot will be recorded separately. Species guilds included in the survey are: warm season grasses, cool season grasses, forbs, shrubs and vines, and total green cover.

7.2.4 Estimating Annual Aboveground Primary Production

Inferences about annual aboveground primary production available for grazing by BTPD is made from estimated foliar cover.